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THE RATIONAL ELEMENT AS AN ORGANIZING PRINCIPLE IN GEOGRAPHY

BY W. J. SUTHERLAND
State Normal School, Macomb, Ill.

IT is the conviction of the writer that there is no failure in teaching more serious than the failure to generalize. The character of certain subjects, and the method of instruction, make them especially subject to such omission. Geography is exceedingly liable to suffer from the teacher's neglect to organize and generalize. The climax of all good teaching is reached in these processes, and any instruction that stops short of them fails accordingly.

In a deductive study, like geometry, every conclusion is a general truth, not only applicable to but necessary in any further development of the subject. Each conclusion is a premise in a succeeding theorem; the subject tends to unify itself. Inductive studies place more responsibility upon the teacher. Because the content of geography is so broad and varied, and because its nature, phases, and values have been so poorly understood, it has doubtless suffered more from a lack of organization than any of the common school subjects.

The old geography devoted itself almost wholly to *fact* study. Vast numbers of items were learned "empirically," as ends in themselves. There was so little sequence, aim, and reason in the subject that it fell far short of a science. It was composed of cross-sections of geology, astronomy, zoology, botany, etc., but the subject-matter was not articulated for a purpose. The old question of "what and where are the following" is suggestive. Isolated and unrelated facts, interesting in themselves but often valueless, because they did not bear upon any generalization, engaged the attention of the student.

The view of geography to-day is—thanks to the scholars in our leading

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universities—rapidly changing. Without attempting to summarize the new view of geography the writer, for the sake of discussion, ventures the following definition:

Geography is the science that treats of—

1. The earth's crust in its present condition.
2. The forces which fashioned this crust.
3. The adjustment and adaptation of life to the crust.

This view of the subject suggests a strong rational element. The study of any region necessitates the consideration of *three* sets of factors or processes. These may be designated as inorganic, dynamic, and organic. The inorganic phase considers the earth's envelopes in static conditions—as the crust, its topography, rocks, soils, minerals; the atmospheric and aqueous envelopes as related to rock-weathering and oxidation, and to plant and animal life. The dynamic deals with the interaction of these envelopes as influenced by heat, gravity and planetary motion. This phase includes the subjects usually treated in dynamic geology. The organic deals with life as fostered by particular combinations of local influences.

It may be said by some that these limits are too broad, but any adequate study of a man's environment leads to all of these investigations. If mere *fact* is the goal of geographical study, then the "why," the rational side of geography may be lopped off and we shall then return to the old basis of teaching the subject. If, however, an *understanding* of the earth as a *habitat* is the object of geographical study, then certainly much value must be placed upon reason and relationship.

Without taking cognizance of the "causal nexus" it would be quite impossible to organize the subject-matter of geography. Careful selection and arrangement of data must precede induction, inference, conclusion. The rational element is the thread upon which the facts are strung. The empirical facts of the old geography were lost as readily as beads from a broken string, but perhaps the loss was not great, because facts learned after such manner are insignificant. Significance comes when order is established, when, as Dr. Harris says, one fact is made to explain another to which it is related. An arrangement of facts to show logical sequence is organization. It assists the memory, clarifies and intensifies the meaning, and leads toward a classification of geographic material.

Men succeed best in industrial life when they best adjust themselves to their environment. To some degree man may modify an unfavorable condition; that being done, the best adjustment is effected when human effort is applied most harmoniously to the remaining natural conditions. Failure

to succeed follows a failure to interpret natural conditions aright. The poor success of the early Puritans is an apt illustration of a poor adjustment to physiographic conditions. The influence of geography on political and industrial history is now generally conceded. It is to this theme that Prof. Brigham and Miss Semple have so successfully lent themselves, and scores of examples could be given to show how natural resources and environment have eventually determined man's residence and occupation. The study of adjustment is one of the most interesting and fruitful phases of geography and emphasizes strongly the rational element. It is held by some that in seeking causes there is danger in going beyond the limits of geography proper, and of entering the domain of pure science. If a bit of science is here or there necessary to explain a condition, then let it strike sharply against the geographical fact of which it becomes a legitimate part, standing in the relation of cause to effect.

Prof. Dryer recognizes the rational side of geography in the following definition of the subject: "The business of geography is first to determine accurately the distribution of each and all the factors of geography (land, water, air, plants, men) and, second, to discover the causes which have brought about the distribution of each; and, third, to explain the relation of each factor or group of factors to all the rest."

Hence cause, relationship and consequence seem to merit special emphasis. Says Prof. Davis: "Another step of equal importance . . . . is the change from the empirical to the explanatory or rational or genetic method of treating the elemental facts that enter into geographical relationships." And again: "The mere existence and location of cities stated independent of their controlling environment fail to become truly geographic as long as they are stated without reference to their cause." Empirical facts in themselves are stern things and offer little freedom to mental action; but facts of relationship challenge the mind to solve a problem, to theorize, to speculate and eventually to induce from what seems to be a heterogeneous mass of facts, a universal law. As soon as this is done, the individual facts arrange themselves in as orderly array about the *law* as do bits of iron about a magnet. May we not call this arrangement and subjection of facts under a general law, organization?

Diastrophism and gradation have been the prominent physiographic processes in Illinois. Let us notice their control over distribution of population, and industrial history. By nature's accidents much of Jo Daviess County, the extreme northwest of Illinois, escaped the grinding and planing of glaciers; but eroding and denuding agencies have removed the later deposits and left exposed the Niagara limestone, Cincinnati shales and the

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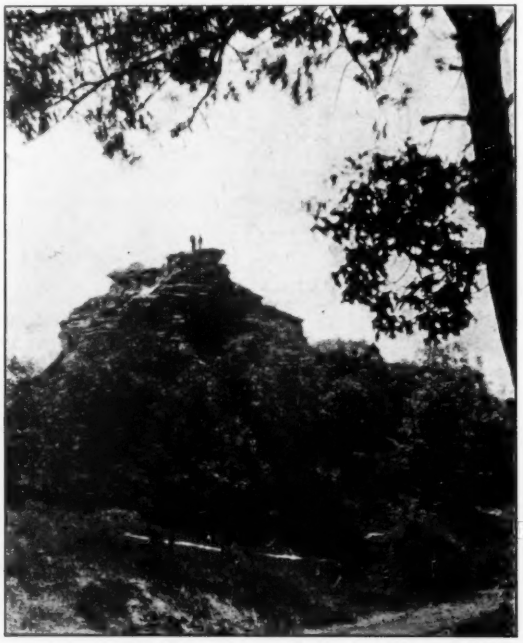
Galena limestone. Galena—lead sulphide—is found in crevices and pockets of this deposit. The city of Galena owes its growth almost entirely to the mineral from which it was named, and its recent decline is the direct result of the exhaustion of the mines. The rough and deeply dissected surface has made a re-adjustment to agricultural pursuits impossible.

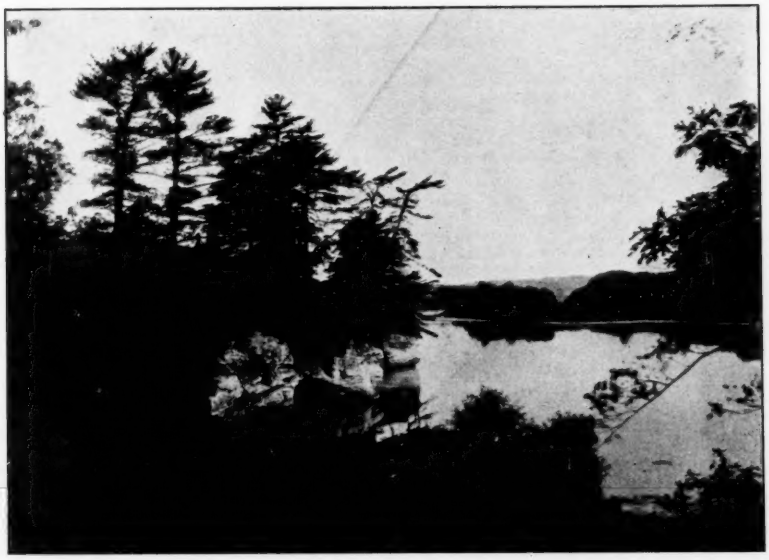
The anticlinal fracture which crosses Illinois in a southeast direction from Stephenson County to Livingston, intersects Rock River a few miles south of the city of Oregon, in Ogle County. For several miles along the



Castle Rock, bank of Rock River, near Oregon, Ill. A Bluff of St. Peter's Sandstone

river this disturbance has brought to the surface St. Peter's sandstone. The beautiful white and buff cliffs fringing the crystal waters have made the region one of rare picturesqueness, an ideal location for the summer homes now building in the vicinity. This sandstone affords unlimited material for the manufacture of glass. The fracture repeats the beautiful scenery where it crosses the Illinois River a few miles east of the city of La Salle. Starved Rock and Deer Park, as well as Castle Rock and Ganymede, have national fame. But it is the effect of this fracture upon

human affairs that concerns us now. The disturbance here brought to the surface the coal measures, St. Peter's sandstone and the calciferous division of the Potsdam, the latter not appearing again within the confines of the State. La Salle is a great mining town and much of the coal is used in smelting zinc ore brought from Wisconsin, Kansas and Missouri. The Illinois and Matthiessen Companies' plants are said to be the largest in the world. Much glass is made from the St. Peter's at Peru, La Salle, Ottawa and Streator. The lower Potsdam is utilized in making Portland cement of excellent quality. East of La Salle where the Rock Island &



Rock River near Oregon, Ill.

Pacific R. R. has tunneled through a hill, the geographer can see the outcropping coal measures, the Trenton limestone, the St. Peter's sandstone and the calciferous division of the Potsdam. The industries of La Salle are directly attributable to this diastrophic movement of the earth's crust, which lifted the coal measures several hundred feet and exposed the early Silurian deposits, making mining easier and more profitable and furnishing abundant material for the manufacture of glass and cement. From the sulphur in the imported zinc ore much sulphuric acid is made as a by-product. So important are natural resources that several railroads and a canal at an early date competed for its traffic.

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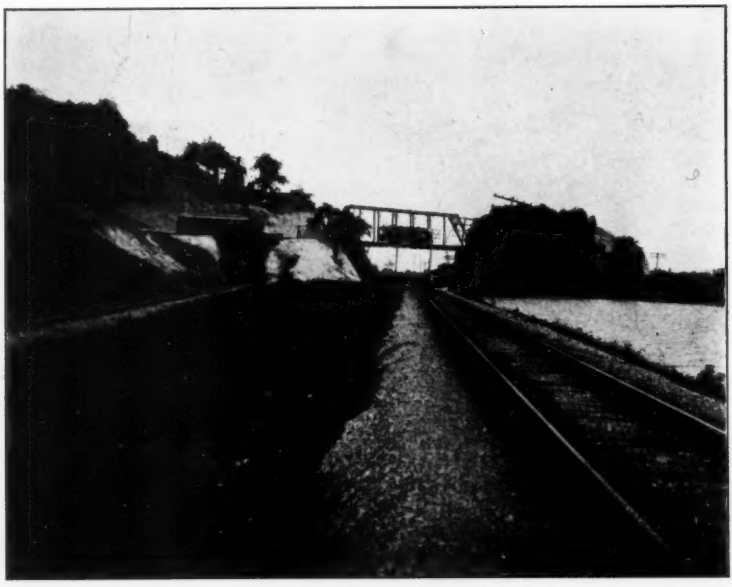
By another of Nature's accidents the lower carboniferous and Devonian deposits are wanting in northern and northeastern Illinois. The absence of these formations exposes the Niagara limestone in many places, it being hidden only by the alluvial and drift deposits. As the later deposits and coal measures appear farther south it is quite likely that this region was not submerged below the great Paleozoic Sea, which covered the central and southern parts of the State, and in which the various formations of the Devonian, lower carboniferous and the coal measures were successively

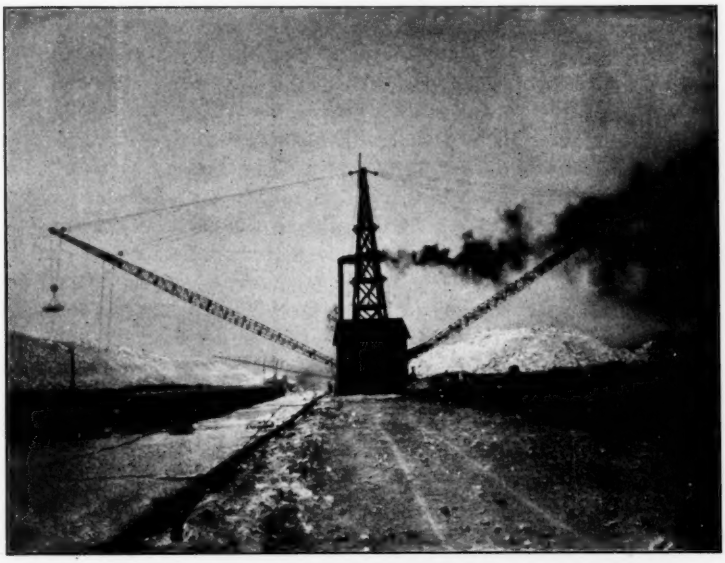


A Geological Study near La Salle, Ill.

deposited. It seems almost providential that so useful a rock should have been left so near the surface, and in such abundance near the site upon which man should later erect one of the world's metropolises. The quarries of Joliet and Lockport constitute one of the leading resources of Will County, and furnish employment for hundreds of men. The excellent quality and abundance of building stone have curtailed the use of brick, Joliet stone being a staple building material in this section of Illinois. "Dimension stone" from this region is shipped to Chicago in large quantities. The Illinois penitentiary at Joliet, built of Niagara limestone, is a constant reminder to the traveler as he passes through the city, that the

quarries constitute one of Will County's chief resources, and "breaking stone" has assumed a double meaning, especially to those whose interpretation of the meaning of freedom is too generous. The falls in the Des Plains River, the Niagara limestone, useful in building, in manufacturing lime, and in smelting, and the proximity of coal fields in Grundy and La Salle counties, have combined to make Joliet a thriving industrial and commercial center.

The great Drainage Canal of Chicago, considered one of the engineer-



Scene in construction of Drainage Canal. Niagara Limestone cut near Joliet, Ill.

ing feats of the age, owes its existence to the results of Nature's play. The retreating glacier left its last great barrier in the form of a semicircle, skirting the southern end of Lake Michigan, and known by the name of the Valparaiso Moraine. This barrier compelled the waters of Lake Michigan to find a new route to the sea, but the drainage from the surface of this ridge cut a notch through the soft drift and made a channel which carried the water southward to the Illinois. It is in the valley of this stream, the Des Plaines, that the Drainage Canal has been constructed at a cost of thirty-five million dollars. Thus, what at first seems to be a great achievement of man, on a more careful consideration, appears to be

only the discovery of one of Nature's great provisions, and the subsequent modification and adaptation of it to serve the needs of mankind.

Instances of physiographic influence could be multiplied. The illustrations given may, to some, seem trite, but they illustrate what the writer considers the richest and most productive phase of geographical study, and emphasize the value of the rational element as a co-ordinating and organizing principle. Mr. George D. Hubbard of Cornell University, in his paper, "A Case of Geographic Influence upon Human Affairs," submits a fine illustration of an agricultural adjustment to physiographic conditions in his study of the Shelbyville Moraine. The influence of physical environment on social life and customs has been discussed by Prof. J. Paul Goode in a valuable paper[1] on "Human Response to Physical Environment."

Modern educational methods react against formalism. The repetition of rules and formulæ is now subordinate and incidental to a comprehension of ideas. The laboratory method in science has substituted for the "letter that killeth," the "spirit which maketh alive." Even the study of a language, with its multiplicity of forms, is successfully approached from the thought side. Why should facts in geography be taught arbitrarily? The whole subject of physiography has to do with cause, and the responses of the organic world are results of effects of certain local sets of conditions. Thus, the "causal," or the "rational," is prominent throughout the subject of geography. Is not, then, this element the logical basis for organization? The value of types is manifest here as in other departments of science. But a type is only a concrete illustration of a general principle which obtains, in slightly modified form, in a multitude of instances. Its value lies in the fact that the student, through cursory examination and hasty comparison of the new example, recognizes the principle and classifies his information.

An instance of *readjustment* to physiographic conditions might be noted in northern Illinois, in the region of the Iowan glaciation. Here, in an early day, wheat was a leading product. Along the Rock River and its chief tributaries, the Kishwaukee and Pecatonica, flouring mills were numerous. The demands of wheat for phosphates and lime so impoverished the soil that its cultivation long since ceased. For some time wheat was imported from Minnnesota to keep these mills running, but the inability to compete with larger and better equipped plants near the wheat fields led to the complete abandonment of the industry. Some of the mills were converted into "feed mills," which found employment in winter but were idle in summer, or ceased to grind altogether. Many have either fallen or

[1] Elementary School-Teacher, January, 1904.

been torn down. In the larger towns, the mills, owing to a large production of oats in the region, became "cereal food" mills. The writer can remember when the Baltic and Big Thunder of Belvidere, Fisher's mill at Cherry Valley, and Shirley's mill were all busily engaged in the manufacture of flour. The Baltic and Big Thunder degenerated into feed mills, the Cherry Valley mill is idle, and only rusty shaft and crumbling stone now mark the site of Shirley's mill. At Oregon, on Rock River, one flour mill was burned, one has been converted into a cereal mill, and another, for many years idle, has recently become the home of a metal and plating company. Instances of this kind could be multiplied. Even as I write, almost in sight of my window, an old mill, weather-beaten and dilapidated, tells the story of industrial readjustment.

Unorganized geographical material has but little value and significance. The educational value of geography increases as the rational element is recognized. The work of the earlier geography is, indeed, to observe, to learn facts, and to gather material; though to some extent, even in this phase, the causal idea may be recognized. When, however, considerable information along various lines has been gained, it seems to be the true function of geography to induce from this information as data, definite general principles. The student may still continue to gather and learn facts, but the time has come when he should have a place to put these facts in orderly arrangement. This comparing and relating of data to strengthen and clarify meaning and to establish general principles which shall serve as categories for the reception of new material, constitute organization as applied to geography. A student who has mastered a few general principles, may then proceed to some extent in a deductive way. Knowing a few general truths relating to a region, he should be able to deduce with considerable accuracy the details of life conditions that prevail, and, looking backward, he should be able to read in outline its geological history. Is it not obvious, then, that the rational element, viz., reason and relationship, should be the major organizing principle of geography and that with the recognition of this principle will increase the educational value of the subject?

MODERN GEOGRAPHY TEACHING

The "Sailor Geography" of the past, with its burdensome details of isolated bits of information, has given way to methods that recognize geography as a logical study admirably adapted to train the perceptive powers, the imagination, the reason, as well as the memory of form and fact. While not necessarily the center from which all teaching should radiate, geography is easily and naturally correlated with other studies.—*Outline in Geography, Stockton, Cal.*

GEOGRAPHIC INFLUENCES IN THE ATLANTA CAMPAIGN

BY F. V. EMERSON

THE Atlanta Campaign is particularly interesting to the student of geography for two reasons. It was influenced in large degree by the resources and topography of the region and it was mainly conducted by generals in whom the "topographic sense" was very keen. Sherman and Jos. E. Johnston were strategists of the first order, who studied their territory with greatest care. Their movements were very largely logical results of earth control.

Sherman says that the march to the sea began with Chattanooga. This was the general's epigrammatic way of saying that the movement from Tennessee southward against the central Confederacy had been long in mind, but the way led through the mountain fortress of Chattanooga, the "shield of the Confederacy." Chattanooga lies at the point where the Tennessee River, coming down the broad Appalachian valley, swings abruptly to the west and cuts its way across the Cumberland plateau. Its valleys and gorges provided a natural pathway from the middle western Confederacy into the Tennessee valley. From Chattanooga railroads following the Appalachian valley radiated northward to Virginia, southward to Atlanta and westward across the plateau to the Mississippi. The possession of Chattanooga was therefore a military necessity to an invading army. Vicksburg had fallen, Gettysburg had been fought when Chattanooga was captured. The Western Confederacy had been sundered by the opening of the Mississippi. Its strength was concentrated in the armies of Lee in Virginia and of Johnston in Georgia. Sherman's task was to pierce the Confederacy to Atlanta and if possible lop off the rest, thus concentrating the fighting in the Atlantic States.

A course from Chattanooga to Atlanta and from thence to the Atlantic lies across three different geological formations, each distinguished by its characteristic topography. Chattanooga lies in the Great Valley, Atlanta in the Piedmont Belt and Savannah on the Coastal Plain.

The Great Valley, as has been noted in the previous paper of this series, is a structural one.[1] Unlike most valleys it is not the work of a river and its tributaries, but its existence is due to the fact that its rocks yield more readily to erosion and weathering than do those on either side. Along the valley belt is a series of upturned strata of limestones and shales; on the east are the resistant crystalline rocks of the mountains and on the west,

[1] Physiographic Control of the Chattanooga Campaign, Jour. Geog., Feb., 1905.

the level strata of the Cumberland Plateau. Of these three formations the tilted strata of the valley weathered fastest and as a consequence the great trough stretches from Alabama to New York.

Relief map of the country from Chattanooga to Atlanta, showing the Cumberland Plateau, Appalachian Valley and Piedmont Plateau. (Photographed from E. E. Howell's model.)

In its southern part the Great Valley is itself divided longitudinally by minor ridges which are remnants of tilted strata which are more resistant than their neighboring strata. At its southern end the Great Valley

widens, its ridges become less distinct or are represented only by fragments, and in Central Alabama the valley loses its identity and merges into the general surface of the Coastal Plain. Referring to the relief map the valley structure is at once apparent from its narrow ridges and parallel streams.

It will be noticed that the country east of the valley and south of the mountains changes in topography. Without any sharp dividing line the valley changes to the Piedment Belt, so called, of course, from its position at the foot of the mountains. Again there is no sharp line of division between mountains and plateau. Indeed they are identical in structure but

View of Piedmont Plateau looking southwest from the base of Lookout Mountain. The rolling surface is shown. (Photograph by the United States Geological Survey.)

the plateau has suffered greater denudation and has lost its mountainous character. What remains of the former mountains are only the roots, so to speak; at least a mile of overlying rock is said to have been removed.

The Piedmont Belt flanks the mountains from New York to Alabama. Its soil is for the most part fertile, and, coupled with a favorable climate, made this region the granary of the Confederacy. The surface is rolling with a stream arrangement in marked contrast with the parallel streams of the valley, as the relief map shows.

The Coastal Plain flanks the Piedmont Plateau from which it is directly derived. The waste of the plateau has been carried eastward and

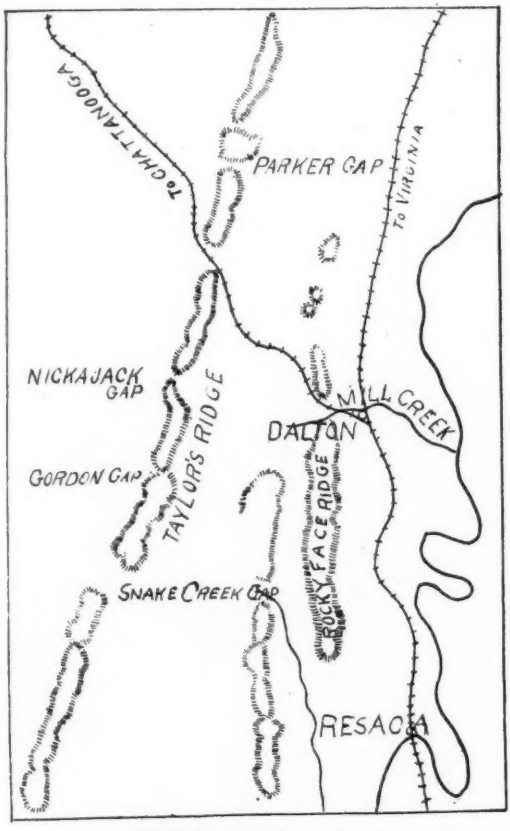
southward to form the nearly level strata of the Coastal Plain. The strata slope gently seaward and in Georgia they form the sandy plains over which the army approached Savannah. The line of transition between Coastal Plain and Piedmont is marked by a series of falls and rapids where the streams descend from the hard rocks of the plateau to the softer ones of the plain.

In the winter of 1863, the armies of Sherman and Johnston lay in the northwest corner of Georgia in the vicinity of Dalton. Here the valley is about forty miles wide. The Great Smoky Mountains, an outlying range of the Appalachians, are its eastern wall and the Cumberland Plateau bounds it on the west. The characteristic valley ridges run northeasterly and in war times they were heavily wooded. The roads sought the valleys and only when absolutely necessary did they wind over the "mountains," as the ridges were called. The railroads crossed these ridges by tunnels, as at Tunnel Hill, near Chattanooga, or used the wind gaps or gorges which the streams had cut. The soil is productive but at that time much of the region was uncleared and neither army could subsist on the country. Both were dependent for supplies on the single line of railroad running from Chattanooga to Atlanta.

Johnston was an able commander whom the consensus of military opinion seems to have placed second only to Lee. His management of the Atlanta campaign has made it classic. It is difficult to get an exact idea of the strength of his army, as Johnston's estimate differs from that of the Richmond government, but it probably numbered between fifty and sixty thousand men. Sherman was a commander, bold but not rash. He was an exceedingly careful student of military affairs, giving close attention to feeding and marching as well as to fighting. Before starting upon this campaign he had from the census office a condensed statement of the resources of each county of each of the Cotton States. Swinton writes that he possessed the "geographical eye": "he invariably noted mountains, ravines and rivers and other features and their military importance." He had at the beginning of the campaign about one hundred thousand men.

Dalton was at the apex of a triangle, the eastern side of which was the mountains and the western side the Cumberland Plateau. Johnston's army was outnumbered and he was a hundred miles from his base of supplies at Atlanta, while Chattanooga, the Federal base, was but a few miles away. He lacked the advantage of interior lines such as were enjoyed by the Confederates in this region before the capture of Chattanooga. On the other hand, as long as he was on the defensive, Johnston had the advantage of position, and as we shall see, the country abounded in positions with

strong defensive possibilities. He had a small army of slaves throwing up earthworks between Dalton and Atlanta, so none of his men need be detached for the purpose. Furthermore, his line of supplies ran through a friendly country and required few troops to guard it.



The Region about Dalton and Resaca

The Confederate position at Dalton was strong and well chosen. It is a railroad junction with roads leading to Chattanooga and Knoxville. Westward a short distance is a high, steep ridge of quartzite whose name, "Rocky Face Ridge," tells the story of its character. Near Dalton the ridge is pierced by the ravine of Mill Creek, a wild, rocky, picturesque gorge, with ridges projecting from the sides. The railroad passed through

this gorge and then on down the vallley. The Confederates had mounted batteries on these ridges and had dammed Mill Creek, making the gorge impassable. Their works extended along the ridge and over the hills north of Dalton. Nature and military science had made the place almost impregnable.

Sherman determined the enemy's position by a light attack and decided that the place was too strong to be carried by assault. Instead he tried a movement which became typical of the campaign. Engaging the enemy with a portion of his army, with the rest he threatened Johnston's flank and line of supplies. This movement was a logical sequence of three factors: the widening valley, which made flank attacks possible; the fact that the Confederate army was dependent upon a single line of railroad for its supplies; and of course the preponderance of numbers in Sherman's army.

Southward in Rocky Face Ridge, about ten miles from Mill Creek Gap is Snake Creek Gap, a narrow defile which the geologists would call a "wind gap," a common feature in the valley ridges from Virginia southward. The name originated from the fact that a cool current of air usually flows through these depressions. The gap was formerly the valley of a creek which flowed across the ridge when the floor of the valley was at a higher level than at present; finally the valley floor on either side was lowered by erosion and weathering faster than the current could cut Rocky Face, and the stream was "bisected," one branch flowing northwestward and the other flowing to the southeast into the Conasauga River. The latter branch is called Snake Creek and gives its name to the ravine.

Either through negligence or lack of troops, Johnston had failed to fortify this door to the valley in his rear and Sherman, holding the enemy's army by a brisk attack along his lines, sent a corps through Snake Creek Gap to threaten or capture the fortifications which the Confederates had thrown up near the hamlet of Resaca during the previous winter. Sherman then leaving a force in front of the enemy strong enough to delay Johnston if he should attempt to move northward, took most of his army through Snake Creek Gap. The Confederate commander could not allow this concentration in his rear and quickly retreated into his intrenchments on a small plateau near Resaca. In anticipation of such an emergency roads had previously been cleared between Dalton and Resaca, so the movement was quickly made.

The turning of Resaca and the passage of the Etowah: Sherman "felt" of the Confederate position by a general attack, which was unsuccessful so far as carrying the position, but on Johnston's left a hill was carried and held, which commanded the railroad and wagon bridge across the river.

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Sherman had secured a ford below the town and had advanced troops across the river and Johnston, fearing an investment of his army, crossed the Oostanaula by night, burning the bridge behind him.

From Resaca on the campaign was conducted on the Piedmont. It was a cotton growing region and was fairly well cleared. There were no protecting parallel ridges as in the valley, so Sherman hoped to bring on a battle here where there were few natural fortifications for Johnston's use. Johnston seems to have decided to try the issue of battle and took a position at Cassville, but suddenly he changed his mind, led his army across the Etowah and took position on the Allatoona heights. Johnston's critics seem to agree that this was his best chance to try a general battle, since Sherman had divided his army, sending a part to Rome. His reason given for not

Allatoona Pass looking north, Corse's Fort on the left. (Drawing loaned by Century Co.)

fighting was that two of his generals, Hood and Polk, advised against the battle.

Near Allatoona the Etowah breaks through a worn down range of hills that were once part of the Appalachians. The railroad crosses the river near here and then bears to the southeastward. Thus the pass is the door to the region traversed by the railroad to Atlanta. Sherman had visited here in 1844 and had formed so high an opinion of its strength that he did not attempt to carry the position.

The Union commander continued his plan of moving by his right flank, but undertook a more elaborate campaign. His aim was to strike the railroad near Marietta, but since the railroad bears to the southeastward, the army would have to carry its provisions until a base could be secured. A base of supplies was established at Kingston, a town near the Etowah, where a branch railroad led to Rome, an important manufacturing town.

From thence the Federal plan was to move south to Dallas and then east along the watershed between the Etowah and Chattahoochee to the railroad. Johnston promptly met his adversary and chose a strong position near Dallas at New Hope church, where roads led to Atlanta and Marietta. The Union army had come across the country with only two days' rations. The occasion, therefore, demanded prompt action. An assault was ordered, but it was repulsed with heavy loss. Sherman now changed his tactics. The country was so wooded that in an hour after

Breastworks near New Hope church, showing forested condition of country. (Drawing loaned by Century Co.)

reaching a position, troops could strongly entrench themselves by falling trees, and soldiers behind breastworks were said to be able to repulse three or four times their number of assailants. The Federal troops would advance as far as possible and then entrench their position. Holding his own entrenchments and constantly skirmishing, Sherman extended his works eastward and Johnston was obliged to meet each extension to avoid being taken in flank.

Allatoona had been evacuated and was taken possession of by Federal cavalry under Stoneman. The railroad was repaired to this place, which was made a secondary distributing point to the troops. The two hostile lines kept stretching out their entrenchments until Johnston became con-

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vinced that his line was too thin to be maintained and he withdrew to a second line of works which had been prepared in advance.

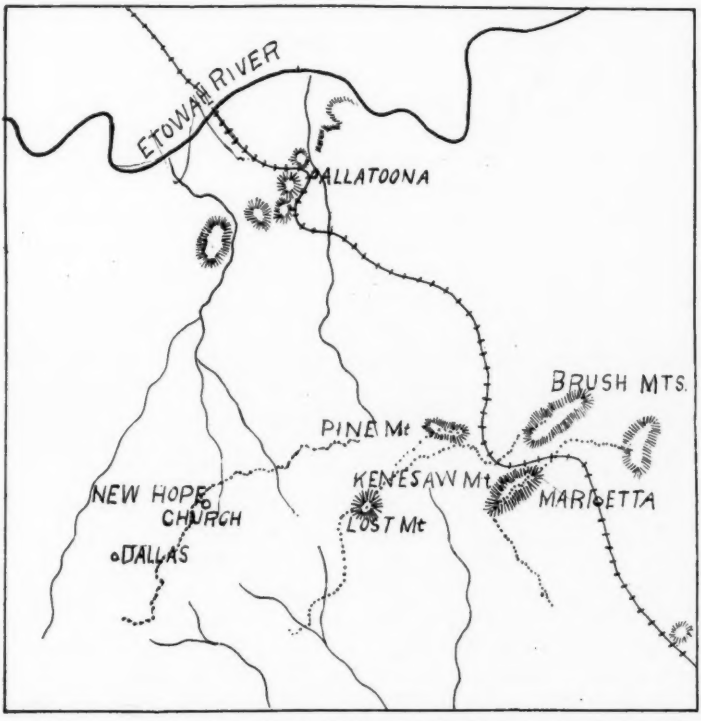
The country about Marietta is interesting to the geologist because of many examples of residual hills or "monadnocks," as they are called. Lost Mountain, Kenesaw Mountain and Pine Mountain, near Marietta, and Stone Mountain, near Atlanta, are famous monadnocks. From the greater resistance of their rocks or from their remoteness from active erosion or perhaps from both causes, these masses have weathered less than their neighbors and stand overlooking the wreckage of the former mountains of the Piedmont plateau. Their military advantage is obvious and Johnston utilized them in his new line of defense, which included Lost and Pine Mountains, a line about ten miles long. However, before his line

Kenesaw Mountain from the southeast. (Photograph by J. E. Murray, Marietta, Ga.)

was invested, the Confederate commander abandoned his line, rightly judging it to be too long for his forces to support.

Another line was in waiting and this being smaller was well manned. The center rested on Kenesaw Mountain while the flanks in either direction protected Marietta, which was a manufacturing town. Sherman, in investing the lines, found them very strong and well protected against assault. He could continue his flanking tactics and probably compel Johnston to retire. But he formed a bold plan. If he could attack the Confederate lines and carry the center he could probably demoralize Johnston's army then and there and end the campaign. Experience had shown that that part of a line which nature had marked as apparently impregnable is often defended by a small force, which can be overcome rather easily. At Chattanooga, Lookout mountain was a fairly easy capture for Hooker, and at Gettysburg, but for the accidental presence of a force that was coming to the field of battle, the Confederates would have taken Little Round Top, the key to the position. Thinking the risk worth while, Sherman hazarded

an attack on all Johnston's lines but especially directed a blow at Kenesaw. Johnston was too wary a commander to be caught. The position was fully defended and the Federals withdrew with a heavy loss. Sherman was preparing to outflank the enemy, when his opponent, not caring to wait for the movement to be executed, retired and did not make a permanent stand until his army was south of the Chattahoochee.



Map of the region included in the campaign about Marietta. The dotted lines show the successive positions of the principal Confederate intrenchments

From Dallas to Marietta had been a unique campaign and the methods of warfare little to Sherman's liking. It had been a continuous skirmish, often, as he says, "without a dozen of the enemy being in sight." His average daily loss had been two hundred.

The Chattahoochee River runs several miles northwest of Atlanta: it is fordable in several places and is crossed by the railroad near the mouth of Peach Tree Creek, a sluggish tributary, flowing for some distance some-

what perpendicular to the river. Johnson made his stand on the hills south of the Chattahoochee, but did not guard the fords and crossings. Soon the enemy had a force across threatening his right flank. The Confederates retired to a strong line of works south of Peach Tree Creek.

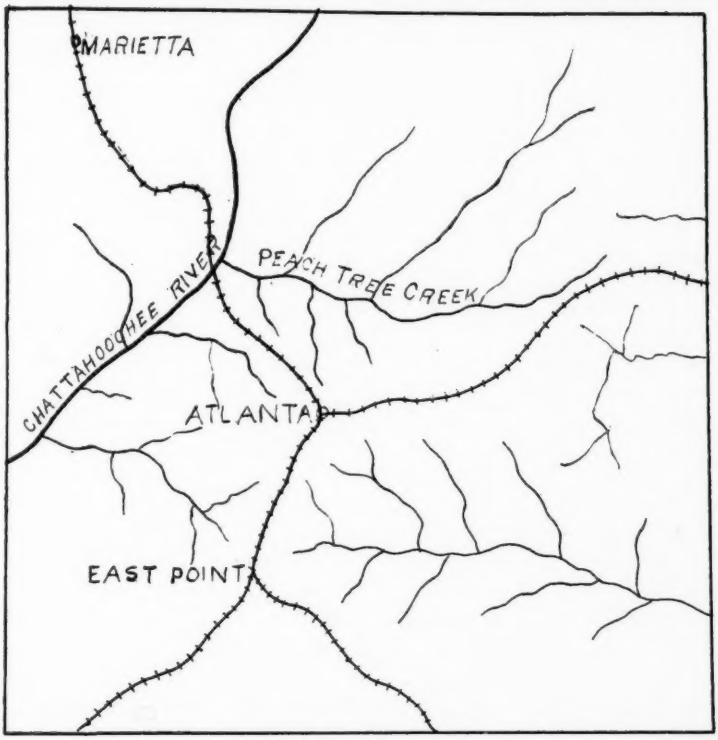
The Federal army was now in sight of its goal, the city of Atlanta. The exact vicinity of Atlanta did not, like Chattanooga, have strategic advantage, but the region roundabout was extremely important. The Appalachians, broadening as they extended southward, constituted a barrier which up to 1880 was not crossed by a railroad south of Virginia. The commerce between the South Atlantic States and the west followed two routes: one led through the Great Valley, by way of Lexington, to Virginia, and the other around the mountains by way of Atlanta. The city was a center of communication for east, south and west. The plateau in Georgia and Alabama yielded iron and coal and the city was then, as today, the center of important iron industries. When the Union soldiers looked over the enemy's works they could see the smoking chimneys of factories that were turning out materials for the Confederate armies. There was a network of important manufacturing towns around Atlanta, among which were Rome and Marietta. Heretofore Georgia had been considered the very heart of the Confederacy. Its industries had gone on unaffected by hostile armies. Because of its seclusion the principal military prison of the South had been located at Andersonville, in the southwestern part of the state.

The city of Atlanta lies on the watershed between the Chattahoochee and Ocmulgee Rivers, the watershed at this point being parallel to the former river. The streams flow in opposite directions from the city. Those entering the Chattahoochee have cut steep ravines, which would be perpendicular to a line of defense, making it difficult to construct works and hard to move troops quickly from one place to another. To the eastward along the watershed was the railroad leading to Richmond. Southward a single road ran about five miles to East Point, where it branched, one branch going to Montgomery and the other to Macon.

Johnston states that in the early stages of the campaign he did not risk battle, as a victory would have meant little and a defeat would have been disastrous. With each retreat his enemy was drawn farther from his base of supplies and was obliged to detach more and more men to guard his line to Chattanooga. He had hoped that Sherman in some of his flank movements would divide his army so that it could be attacked and the parts beaten in detail. Now it seemed to Johnston that his opportunity had arrived. Sherman's center was more or less stationary; it was necessarily

near the railroad. Johnston planned to hold his strong works in front of the enemy with a comparatively small number of men and when the enemy attempted a flank movement to pounce upon him with a superior force.

Sherman studied his problem. By moving to his right he could threaten Atlanta's southern railroad connections and compel the enemy to operate in a country unfavorable for defense. But he would stretch out

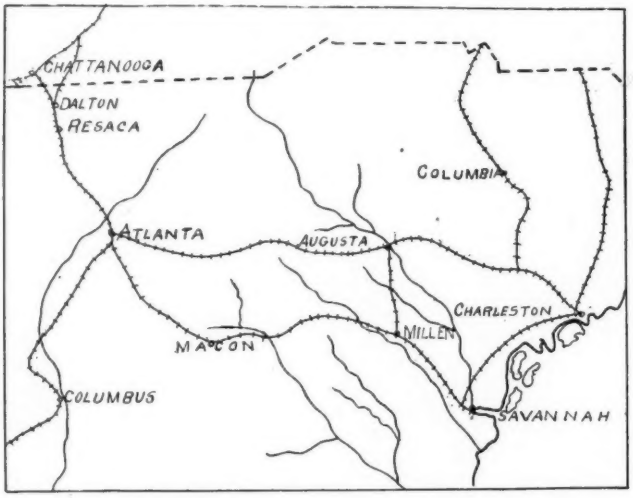


Map of the vicinity of Atlanta

his own line and imperil his connection with the ever necessary railroad. Moving by his left flank he would have less distance to cover, but the streams ran parallel to the enemy's position. The latter was the line of operations he chose: it was the movement which Johnston had anticipated and as we have seen, was planning to resist.

But Sherman's plans were made easier by President Davis. The Confederate government had become tired of Johnston's "Fabian policy" and

he was replaced by General Hood, who had commanded a division of Johnston's army and had severely criticised his chief's defensive tactics. This change was a cause of rejoicing among the Union officers. It was understood that the patient, alert parrying of Johnston was to be replaced by an "aggressive" policy, for which Sherman had so wished and had tried to compel from his "astute adversary." The *post bellum* judgment seems to be that Johnston had conducted a wise and masterly campaign. Indeed, the most unstinted praise of his ability has come from his antagonist, who says in his memoirs: "No officer or soldier under me will question the generalship of Joseph E. Johnston. His retreats were timely and in good



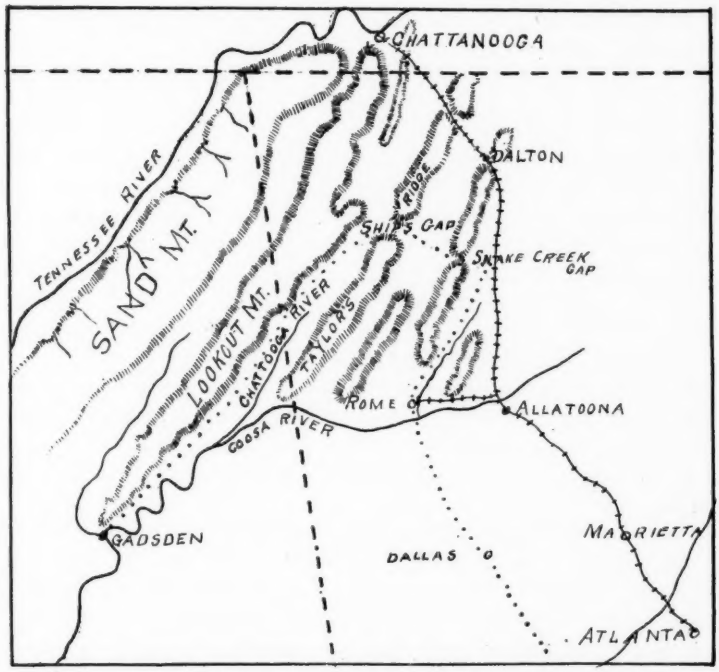
Map of the region included in the Atlanta campaigns

order and he left nothing behind." Another officer laughingly complains that "in all his retreats Johnston didn't even leave a mule behind."

In accordance with the policy imposed upon him Hood sallied out and attacked the Union left flank, but was repulsed with heavy loss. He then withdrew his army into the intrenchments about the city. McPherson's corps, protected by cavalry, continued the movement eastward and destroyed several miles of the railroad leading to Richmond and Sherman's first purpose had been accomplished. Taking fifteen days' rations he now began to move by his right flank in order to cut the railroads south of Atlanta. Hood fiercely attacked again, but was repulsed. The Union line

pushed south, destroyed the railroads and Hood was forced to abandon Atlanta.

The apparent purpose of the campaign had been accomplished, but Sherman's ulterior purpose was to destroy or capture the army before him and then to march up the coast upon Lee. However, Hood's army of forty thousand men was very far from being destroyed. It was a constant menace upon Sherman's long line of supplies. The primary base was at Louis-



Map showing region included in Hood's campaign after the fall of Atlanta. His line of march is shown by the dotted line

ville; from thence to Nashville the distance was 185 miles; from Nashville to Chattanooga was 151 miles and from thence to Atlanta was 137 miles, in all nearly 500 miles, of which 300 lay through hostile territory. Every bridge, culvert and trestle had to be guarded and every train was accompanied by a repair force. One hundred and forty-five cars a day must arrive at Atlanta to maintain the army.

Sherman's position was somewhat precarious. Every effort was made to accumulate at Atlanta sufficient supplies to maintain his army for a

considerable time, even if the railroad should be broken. The enemy was fully alive to the importance of the Chattanooga road and soon Hood put his army in motion, crossed the Chattahoochee and the army in light marching order was soon in the vicinity of Marietta. Sherman followed with a portion of his army and from the heights of Kenesaw saw the smoke of the burning railroad twenty miles northward. Hood's main army was near Dallas, but a strong Confederate force was sent to capture Allatoona. Gen. Corse's there made a strong, successful resistance. It is interesting to note that the signalling between Generals Corse and Sherman was the basis for the well known song, "Hold the Fort for I am Coming."

Hood withdrew at the approach of the Union army and, turning northward, crossed the Coosa. The Oostanaula, a tributary of the Coosa from the north, was swollen by recent rains and protected his right flank. He moved upon Resaca but was not able to capture the place. Sherman was getting uncomfortably close and Hood, following Sherman's path of the previous campaign, turned west from Resaca through Snake Creek Gap and Ship's Gap and entered the Chattanooga valley. After the retreating army filed through the gaps, trees were felled across them so that pursuit was slow. The Confederate army, turning southward, proceeded to Gadsden, Ga. It was protected in the retreat by two physiographic factors: Taylor's Ridge on the east was an effective wall between him and the enemy, while the general southwest trend of the valley carried his army farther and farther from Atlanta. The campaign had been brilliant but fruitless. The broken railroad was soon repaired and trains were again running to Atlanta.

Sherman now had three courses open to him: he could hold Atlanta as a base and send out raiding forces into the surrounding country; or he could follow Hood in the hope of destroying the Confederate army; or, if Hood could be disposed of, he could carry out his cherished project of marching to the Atlantic seaboard.

Again the Confederates did precisely what Sherman wished. Hood started for Tennessee, hoping that his enemy would follow. The Confederates left the valley and crossed the Tennessee River at Florence Shoals, about one hundred and fifty miles below Chattanooga. Sherman detached General Thomas with a force strong enough to hold Hood's army and at once set about his famous march, first destroying the railroad from Chattanooga to Resaca, thus releasing the troops who were guarding the line and making it useless to the enemy.

From now on Sherman's primary object was to cripple Lee's army, which was besieged at Petersburg, Va., to cut off his supplies and finally

to march northward and, if need be, attack in conjunction with Grant's forces. Three routes were possible; by Augusta to Charleston; southeastward to Savannah, or southward to some Gulf port. Sherman so maneuvered that the enemy was uncertain as to his route until he was well started.

The army of about sixty thousand was divided into wings which marched on parallel roads, covering a front of fifteen miles or more. About ten days' rations were taken in wagons, but these were rarely drawn upon. For once a Union army found itself in a country on which it could live. President Davis had aided materially in obtaining forage for the horses and men. Cotton was unmarketable because of the blockade and the Confederate president had issued a proclamation urging the people to plant corn instead of cotton. The appeal was heeded and as a result there was plenty of corn and fodder for man and horse. There was practically no opposition and the armies marched on the average about fifteen miles a day. Upon reaching the vicinity of Millen, Ga., the armies passed from the Plateau to the Coastal Plain. The soil became sandy and less fertile and supplies were scarcer. On the river bottoms rice and rice straw were foraged instead of corn and corn fodder. The food supplies in the wagons were drawn upon and well nigh exhausted, and had it not been for the junction with the fleet at Savannah and absence of resistance to the march, the Union army would have been seriously embarrassed for food. The falling off of plentiful supplies on the Coastal Plain compelled the Federal officers to dismiss the slaves who followed in large numbers.

The entire march was devoid of important engagements. On Christmas day, 1864, Sherman reported the evacuation of Savannah. The movement had been at once *felt* by the Confederate soldiers in Petersburg in their reduced rations. A path sixty miles wide had been cleared of anything a hostile army could use. Atlanta had been captured, the Confederacy had been again sundered and the purposes of the great march had been accomplished.

HISTORY AND GEOGRAPHY

History is full of the great movements of humanity that have developed outbursts of intellectual development—indeed it is these same movements that constitute history. And no matter what may seem to be the intermediate cause, the real motive may be traced always to the same incentive—geographic environment.—*J. W. Redway, in New Basis of Geography.*

LABORATORY WORK IN PHYSICAL GEOGRAPHY IN SECONDARY SCHOOLS*

BY CLARA B. KIRCHWEY

Instructor in Geography in Horace Mann School and Teachers College, New York City.

THE geography of to-day or the "new geography" as it is called, burdened by its inheritance from the past and by its own shortcomings, has a reputation difficult to live down—that of being simply an information subject. Until very recently it was primarily what its definition implied—a description of the earth's surface—and although we have passed beyond the letter of this definition, the spirit still persistently lingers. Geography is still too widely taught as an information subject. The "six pages a day" method may acquaint a pupil with the words within the covers of his text book, but it will not teach him geography, and fortunately will no longer make it possible for him to present himself as a candidate for college entrance in physiography.

The day is long since past when instruction in chemistry, physics, or biology was confined to the printed page. The instructor in these sciences realizes the inadequacy of words in conveying ideas and the need of investigation on the part of the pupil that he may arrive at an understanding of the underlying principles.

This attitude is as essential to progress in geography as it is in biology. Geography, too, is a science, and must be granted the prerogatives of a science. The subject, correctly handled, has great possibilities for mental discipline; as it is often treated these possibilities are so obscured that they are visible only to those familiar with the field. We can scarcely wonder that the uninitiated still see in geography a mass of unrelated facts and refuse to give credence to the argument that its disciplinary value is equal to that of the other sciences.

Geography labors under more or less of a disadvantage, owing to the fact that its problems are not such as can be analyzed under the microscope or studied in the test tube. We cannot bring our material for study within the walls of the school room, nor can we go where we will in pursuit of geography. We are therefore forced to content ourselves, to some extent at least, with the shadow, the substance being unattainable, and with the laboratory rather than the field as our *locus operandi.*

To the laboratory then, and to laboratory work must be entrusted the task of so organizing the subject that the process of accumulating information may be accompanied by true mental discipline. When this is accom-

*Read before Earth Science Section, New York State Science Teachers' Association, 1904.

plished the less important task—that of establishing the position of geography among the other sciences—will require no advocates. Cause and effect have been operative in the past in determining the standing of geography and may be depended upon for the future.

In order to make laboratory work effective an elaborate equipment is not essential, but a realization of what may be accomplished by this method is absolutely necessary, that its end may not be defeated. That so-called "laboratory work" covers a multitude of sins at the present time may be seen by an examination of the laboratory note books presented by the candidates for admission to college. Many of these exercises have no place in such a category. Class discussions, bearing no evidence of investigation of any description on the part of the student, are frequently submitted. Exercises, performed by the teacher and copied by the pupils, are also presented, apparently with no intention to deceive either on the part of the instructor or the student, but rather from a misconception regarding the true meaning of laboratory work.

While the leaders in the field are agreed that there should be laboratory work and that it should be disciplinary in character, the greatest diversity of opinion prevails among them regarding the exact nature of this work and the best mode of presentation. This lack of agreement is made evident in the manuals which have been published within the last few years. The various possibilities in regard to the choice of material and in the method of treatment have not been weighed that some common ground might be reached, but each author has emphasized the subject or subjects for which he has some special preference. The result is a collection of books, no one of which should be used alone as a laboratory guide. Until we have a greater unanimity of opinion among those who would shape the destiny of geography we must not expect systematic, well-ordered work on the part of the teacher whose training has not given him a broad outlook over the subject, nor can we expect unsystematized work to result in well disciplined minds.

There is some excuse for the fact that the work is not well apportioned among the various departments that constitute physical geography. The subject, embracing *"The Earth as a Globe," "The Atmosphere," "The Ocean," "The Lands"* and *"The Distribution of Life"* is much too extensive to be covered from the laboratory standpoint or even with a sufficient amount of emphasis on laboratory work in the period of time usually allotted to it—*i. e.*, one year, with three or four periods weekly of perhaps forty minutes each. This has been attempted for several years, the result being work too superficial to be satisfactory to the instructor, not

thorough enough to give the student a clear understanding of the subject, and less intensive than he is capable of performing.

In view of these conditions it seems desirable that some common method of elimination be adopted that in time we may arrive at a greater uniformity of treatment and at more satisfactory results. The basis of selection should naturally be that of true educational value primarily. It is therefore necessary that each department of geography be submitted to a critical examination, that its relative value from this standpoint may be determined.

The fundamental division of the subject, *The Earth as a Globe,* usually regarded with equal aversion by both instructor and pupils, lends itself admirably to laboratory treatment and so taught it is seen to be so full of vital problems that it is impossible to look upon it as a dry subject, or one which is pursued simply to fulfill a requirement. The pupils may regard it as difficult, for each point must be thoroughly grasped before further progress may be made, and before any truth becomes a permanent possession, close thinking and frequently a considerable power of visualization are required. This is "hard" in the process but its accomplishment illumines the subject as no amount of class discussion or assigned reading can succeed in doing, and that which would otherwise be true on the authority of the teacher or the text, becomes so to the understanding.

Perhaps the problems of greatest difficulty in the treatment of the Earth as a Globe are those based on the effects of the revolution of the earth about the sun. The distribution of light at different seasons and at different latitudes may be memorized, but memory work is so transparent that a modification of the usual form of the problem will expose it. If a pupil truly realizes the combined effects of revolution and the inclined axis, that axis may be inclined at any imaginary angle without causing confusion to his mind. If it be grasped, not memorized, that the inclination of the axis determines the width of the zones he will not be at a loss if he be confronted with an earth in which the axis has an inclination of 30° or 40° and the number and width of the various zones are left for him to determine. The varying lengths of day and night at different latitudes, as at the equator, the polar circles and the poles, another problem involving difficulties, when approached in the laboratory from the side of light distribution, needs little explanation on the part of the teacher.

These problems may be solved without an expensive laboratory equipment; a season apparatus is of course desirable as the basis for this work. If this cannot be secured, small globes, together with circles of illumina-

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tion, cut from paper, will be found a good substitute; indeed, this should be used even if the more elaborate apparatus be available.

If time permitted it might be shown that it is possible to develop practically this entire subject in the laboratory, leaving for the lecture or discussion the summary, amplification and application of the results reached through individual work.

Another department well adapted to laboratory treatment is that of *The Atmosphere,* and no subject should be more thoroughly studied. The material for this work is always at hand, furnishing a field for investigation that cannot be surpassed.

In the study of the atmosphere the pupil is largely independent of the teacher except for guidance. A clearer conception of temperature distribution may be gained from the study of isothermal maps than from a lecture. The problems should be formulated with care by the teacher, but the solution should be left to the pupil. A similar mode of procedure in regard to the distribution of pressure will show not only the variation of pressure over the world but the reason for that variation, with the single exception regarding the cause of low pressure at the poles.

Familiarity with pressure should carry with it ability to cope with the next problem—that of the various wind systems. The pupil should be required to sketch the approximate direction of the winds in the various belts, not alone in the fundamental planetary system but in that of the terrestrial as well, judging of wind direction from his knowledge of the distribution of pressure and the direction of deflection. The results should be verified and corrections made when necessary. The study of the distribution of rainfall should be causal also, the interpretation of the rainfall map depending on the knowledge of wind direction and surface features.

The series of questions which follows indicates more definitely the mode of procedure recommended and the close causal relationship existing among these various topics. The problems are based on climatic maps which may be found in Longman's New School Atlas.

ISOTHERMS FOR JANUARY

1. Record the temperature of the eastern coast, the western coast and the interior of North America along the parallels of 30, 40, 50, 60 and 66½ degrees.
2. Record the temperature of the eastern coast, the western coast and the interior of Eurasia along the parallels of 40, 50, 60 and 66½ degrees.
3. Compare the temperature of the east and west coastal regions of North America; compare each coast with the interior; compare

the east and west coastal regions of Eurasia; compare each with the interior.

4. What is the trend of the isotherms in the interior of these continents? Over the adjacent oceans? Suggest the reason for their irregularity.
5. Where is the coldest land area found? What is its temperature? Where is the warmest land area found? Record its temperature.
6. Compare the trend of the isotherms in the northern and southern hemispheres. Explain.
7. On an outline map of the world indicate the position of the heat equator.

After a similar study of the distribution of temperature over the world for July, followed by that of the yearly average, the distribution of pressure is noted.

ISOBARS FOR JANUARY

1. Locate the equatorial low pressure belt. What is the average temperature of this area? (See isothermal map for January). Where is the pressure lowest in this belt? What is the temperature of these areas?
2. Locate the barometric equator. Compare its position with that of the January heat equator.
3. Locate the north tropical belt of high pressure. Describe the temperature of this belt. Where is pressure highest? What is the temperature of this area?
4. Compare the south tropical high pressure belt in extent and continuity with the north tropical. Explain.
5. Describe the pressure about the poles.

After a similar study of the distribution of pressure for July and for the year the pupils should state what relationship they have discovered between temperature and pressure and what exception to this relationship appparently exists. This exception, low pressure at the poles, must be explained as the cause cannot be discovered in the laboratory.

The study of pressure is immediately followed by that of the wind systems.

WINDS

Planetary:

Draw a circle representing the earth. From your knowledge of the average distribution of pressure over the world for the year and of the law of deflection, show the approximate direction of the winds.

Verify from consultation of wind chart and correct errors.

Terrestrial:

Construct two diagrams showing the effect of the migration of the heat equator upon the planetary wind system.

(Diagrams should represent the distribution of winds for January and for July).

Moonsons:

Draw two outline maps of India. In each case represent the mathematical equator. On one map represent the heat equator for January and the consequent distribution of winds for the same month. On the second map represent the heat equator and winds for July. Verify as before and correct errors.

RAINFALL

1. Account for the amount of precipitation in regions of greatest and least rainfall.
   (Consult map of winds and physical maps, as well as rainfall maps.)
2. Compare the extent of desert regions of the eastern and western hemispheres. Explain.
3. Locate the great trade wind deserts.
4. Explain the distribution of rainfall along the western coast of South America.
5. Compare the amount of rainfall east and west of the 100th meridian west of Greenwich. How have life conditions in this section been influenced by the amount of rainfall?
6. State the amount of rainfall of the Great Basin region of the United States. What influence has the light rainfall had upon the drainage of this section?

These exercises have been formulated to show the causal relationship existing between temperature and pressure, pressure and winds, winds and rainfall. They are typical, however, not only of the work on the atmosphere but also of that of the other departments of the subject, to the extent that they emphasize causes and consequences.

Neither department of geography which has been considered has held as prominent a place in secondary school education as has that of *The Lands*. We are told that this topic should be emphasized, for the land is the home of man and pupils must therefore be made familiar with it.

If this subject be examined from the standpoint of its educational value, we may not feel so confident that it is entitled to as much attention as it has received in the past. The field is so broad and is so detailed that to approach it through the laboratory is somewhat appalling unless the time

devoted to geography be greatly extended. Moreover, the laboratory seems to fail us here to some extent, for, instead of furnishing a field for the interpretation of the most difficult problems these must be reserved for the lecture. The simpler problems, such as the characteristic surface features of a plain, a plateau, a mountain, etc., may be studied with profit, also the various stages of development of these land forms. Only a comparatively small portion, however, of all that our texts usually require, can be taught in the laboratory. For example, the high school pupil is supposed to be familiar not only with the characteristics of plains in general, but with the divisions and subdivisions of plains. He must know not only coastal, alluvial, and lake plains, but the characteristics of narrow, broad, belted, belted inland, and embayed coastal plains. The distinguishing features of all of these various divisions and subdivisions cannot be arrived at successfully through the laboratory. It is difficult to see how a pupil could determine the development and the characteristics of a belted plain from map study. In considering the various classes of mountains similar difficulties are met with. The attempt to analyze the various forms from map study is unsatisfactory, for in most instances these forms are so modified that their characteristic features are obscured.

These same conditions exist to a sufficient degree in the various topics that must be considered to render laboratory work as the basis for class work practically impossible. Moreover the amount of detail necessary for the appreciation of many of these subjects is so great that it seems almost necessary for the text-book or for oral instruction to lead rather than for the laboratory. The chief function of laboratory work must therefore be that of illustration wherever it is possible to clarify a subject through the study of maps, models or photographs, or to summarize some portion of class work.

There is a distinct mental relaxation on the part of the pupils when land forms are reached. The weaker student who has found the preceding work beyond him, or practically so, is almost invariably able to cope with this department without great effort. The reason for this is apparent. The subject matter, though voluminous, is not difficult. The method of work, enforced by the nature of the subject, demands much less of the pupil, the close, sustained thinking which the previous work has required being no longer necessary, so small a portion of the work being really independent investigation.

In view of the fact that it is an impossibility to cover satisfactorily the entire course of physical geography as outlined for secondary schools by the leaders in the field, it would certainly seem advisable to cut down the re-

quirements on land forms decidedly for the reasons mentioned. If much of this subject were reserved for college and were studied after the student had some knowledge of geology, that the relation between structure and surface might be emphasized, its disciplinary value would be greatly increased.

It is therefore recommended that secondary work on land forms be confined to the larger features, leaving for more advanced study the careful analysis of these various forms; *i. e.,* the various classes of plains and their development should be studied, but not the subdivisions based on structure—as narrow, broad, and belted coastal plains; mountains and their development, but not block, folded, domed and massive mountains; plateaus and volcanoes, together with their development, but not the subdivisions of these forms. The two classes of shore lines should be emphasized, owing to the strong influence which they exert upon the development of human life. Many other topics belonging to the lands should be subjected to the same process of reduction. Rivers, for example, should be studied as young, mature and old, while their classification as consequent, subsequent, obsequent, antecedent, superimposed, engrafted, dismembered, etc., should be reserved for the college. By thus limiting the field an opportunity for better training would be afforded, for the subjects chosen might then be approached through the laboratory, time for investigation being adequate or approximately so, and the subject being of a nature to admit of laboratory treatment.

The next department of geography for consideration, *The Ocean,* has never held an important position in the course from the standpoint of the time devoted to it. Many of the problems to be considered, however, can with advantage be presented in the laboratory, the subject affording, therefore, an opportunity for some independent work that is valuable. The omission of two or three problems that must be largely descriptive on the part of the instructor, as that of the movement of water particles in a wave, or the detailed and involved explanation of tides, would certainly be no detriment to the course, and would afford an opportunity for the study of topics more valuable to secondary pupils, as those relating to the relationship between ocean temperatures and the movement of ocean waters, the dependence of the direction of ocean currents on the prevailing winds, etc.

The final department left for discussion is that of *The Distribution of Life.* If the work has been well done throughout, life relations have been constantly emphasized. The response of life to its environment, however, whether it be water, land or atmosphere, should be studied when that en-

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vironment is studied, *i. e.,* when climate is considered, its effects upon life should be traced; when seashores are considered the influence of shorelines upon the development of peoples naturally follows. If life relations be studied in connection with each topic considered throughout the work on *The Earth as a Globe, The Atmosphere, The Lands* and *The Ocean,* it will be found unnecessary to treat it as a separate department to be discussed after the completion of the study of the physical environment, as is customary.

Moreover, this department of physical geography is naturally impossible from the standpoint of the laboratory; and while the argument is not advanced that no mental discipline is involved in the pursuit of such a subject, the claim is made that less discipline results than where independent thought work is absolutely required.

Geography taught by the laboratory method must necessarily be stripped of much that is generally thought to be its most interesting side. If this were true it might still be worth the sacrifice. That the opinion is erroneous will be asserted by those who have investigated and fairly tested this method. The process of solving a problem for which there is a sufficient motive is always interesting to every active minded boy or girl.

The laboratory method, moreover, is disciplinary in its character, affording opportunity for pupils—"To proceed by observation and experiment, by guarded hypotheses and careful verification, from the known to the unknown, on the well-founded assumption of the uniformity of nature."

A student cannot pursue a subject in this manner without gaining a large fund of information which has some value. His chief gain, however, lies in the attitude of mind, which must follow the constant weighing of causes and consequences, in the independence which this work promotes, and in the power which results from the successful accomplishment of a task and the immediate application of the principle deduced to the interpretation of new problems.

And, lastly, geography taught by this method will make for itself a place among those established sciences whose aim is not information primarily, but an attitude of mind which the study of a science according to the methods of science alone can give.

THE SCOPE OF PHYSICAL GEOGRAPHY

The meaning and general scope of physical geography have never been better expressed than in the words, "the physical environment of man."—*Report of Committee on College Entrance Requirements, 1899.*

SOME CONTRIBUTIONS TO LABORATORY PHYSIOGRAPHY*

BY WM. F. LANGWORTHY
Colgate Academy, Hamilton, N. Y.

THE educational world has been slow in recognizing the importance and practicability of laboratory work in Physiography. At last the time seems at hand for its general introduction. Many, and perhaps most, educators will agree that as much attention should be given to laboratory work in this subject as in Physics or Chemistry.

I have been asked to describe two or three exercises which I have planned or have found especially valuable with my classes. I do not feel that I could do this helpfully without some general suggestions as to laboratory work.

In the first place, it seems wisest to use both laboratory and field exercises in connection with a good text-book. The observations in the field make clear many facts otherwise only indistinctly understood, and develop an intelligent interest in nature. Work in the field should proceed side by side with laboratory work.

The laboratory exercises should be distributed as generally as possible over the different parts of the subject. Equipment with topographic maps and all that is necessary to carry on work with them is very easily and economically provided. Probably this fact, as well as the importance of the work itself, will make such work very prominent in any laboratory course. In our own State these maps are coming from the survey with great rapidity and make work on the home map possible in an increasingly large number of localities. I find it a good plan to begin work on maps with a comparison of different ways of showing relief and attempt to bring out as clearly as possible the advantages of the contour map. With the topographic map of our locality before the class, definite questions are put as to scale, contour interval, features shown by brown, black, and blue ink, etc. This is followed by a change of a part of the map to a hachure map. Students find this hard because of a failure to understand hachure maps. One or two profiles are then constructed across our village, taking pains not to exaggerate the vertical scale too much. These profiles cover territory which students go over in the field with map in hand. Various features revealed by profile are then discussed. For instance, the student's attention is called to the fact that the valley in which Hamilton is situated is an open, mature valley. Our profile, however, crosses two branch valleys

*Read before the Earth Science Section, New York State Science Teachers' Association, December, 1904.

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which are young and one which is fairly well developed. Another feature emphasized is the rounded summits of the hills, with causes. Other exercises on the home map follow until the student becomes familiar with its details as seen in field and represented on map. The student is then ready for the study of other maps, and this work has been made more easy and tangible.

So much improvement has been made in training pupils in drawing and map making that we find it possible to require much work of this kind. I prefer it to using outline maps already prepared. Of course, these maps lack accuracy of detail as compared with printed outline maps and consume much time in construction, but the knowledge of one doing the work seems to be increased much faster.

The following are some of the exercises which I give my classes after they are fairly well advanced. Each of these exercises requires two fifty-minute periods for its completion. The first is an exercise on the "River Basins and Divides of New York State:"

1. Construct outline map of New York State and trace divides separating St. Lawrence, Hudson, Delaware, Susquehanna, and Mississippi drainage.

2. With crayons color St. Lawrence basin blue, Hudson red, Delaware blue, Susquehanna yellow, and Mississippi red.

3. (a) What is the highest elevation in the State?
   (b) Is New York a high upland?
   (c) Is the fact of the wide dispersion of its waters unusual?

4. (a) Near what divide do we live?
   (b) What is its elevation in our valley?

5. (a) What is the average slope from source of Oriskany Creek to where it empties into the Mohawk?
   (b) For whole distance from Bouckville to tide water?

6. (a) What is the average grade in our valley from divide to Binghamton?
   (b) From divide to Chesapeake Bay?

7. (a) What is the result of this condition?
   (b) Do you see any evidence of this on Morrisville sheet?

The next exercise deals with the "Temperature and Precipitation of New York State."

1. From charts in Annual Reports of New York State Weather Bureau and the New York Section of the Climate and Crop Service of the Weather Bureau for the past ten years determine average annual temperature and rainfall at Hamilton. Arrange data in table.

2. Why do isotherms bend to the north in the Hudson Valley?

3. How much lower is the average annual temperature in the Adirondacks than in the St. Lawrence Valley? Account for this.

4. Where is the highest average temperature in the State found? Explain.

5. How does the average rainfall in the Adirondacks compare with that at the east end of Lake Ontario? Explain.

6. In what parts of the State is the heaviest precipitation found? Explain.

The last exercise is a "Study of the Cucamonga, California, Map."

1. Locate Cucamonga map on general map of California.
2. How many square miles of land is covered by it?
3. What is the contour interval?
4. (a) What mountains lie to the north?
   (b) What is their elevation and character?
5. (a) What mountains lie to the south?
   (b) What is their elevation?
6. What is the length, width, and elevation of this valley?
7. (a) What is the average slope per mile from Cucamonga Peak south for four miles?
   (b) What is the slope from foot of mountains south to Cucamonga?
8. Make profile from Cucamonga Peak to Cucamonga.
9. What do you know about the rainfall of this region?
10. How does this find expression in streams from mountains?
11. (a) Are most streams lowering their beds?
    (b) How about these?
12. (a) What relation to the mouths of the gorges do the contours have?
    (b) How do you explain it?
    (c) What do you call such topographic forms?
    (d) Notice distributaries.
13. (a) What do you know about the climate of this region?
    (b) What alone is needed to make it exceedingly fruitful?
    (c) What measures are taken to obtain water for irrigation?
    (d) What has become the chief industry?
    (e) How valuable is the land?
14. Recapitulate the conditions which make this region especially favorable for the formation of alluvial fans and cones.

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In conclusion I wish to say that in secondary schools the laboratory work in Physical Geography should be very simple and elementary. We often underestimate the difficulties of beginners. Our work should be definite. Otherwise discouragement is sure to result. Do not take a pupil into the laboratory, place a map before him and ask him to explain what topographic features are shown. Skillful questioning will bring him to the correct understanding of the problem presented. To illustrate what I mean, be careful to insure a good understanding of the flood plain feature of the Mohawk at Utica and the Mississippi at Donaldsonville, La., before you expect him without the aid of definite questions to discuss those of the Missouri at Marshall, Mo. Do not undertake map excursions, so called, until the student is well advanced. There is an exactness of relations between cause and effect in Chemistry and Physics which is to some extent lacking, or perhaps imperfectly understood, in Physical Geography, and we need to guard against bewilderment by using especial care to guide our pupils by a large number of pointed questions. If this is done, I am sure we will be pleased with their development.

NEWS ITEMS

INTERNATIONAL COMMITTEE ON EDUCATIONAL GEOGRAPHY.—As an outcome of the meetings of the educational section of the Eighth International Geographical Congress held in this country in September, 1904, an international committee has been formed under the leadership of Professor Heinrich Fischer of Berlin to promote the advancement of educational geography. The committee arranged for by Professor Fischer includes, besides the chairman, who will represent Germany, Professor Oldham of Cambridge, England, for the United Kingdom; Professor de Martonne of Nancy, for France, and Professor Dodge of New York city, for the United States. The committee will publish, at least biennially and perhaps annually, accounts of the progress made in educational geography in the different countries represented. These reports will be published in the existing educational journals and should be of much service to all who would keep in touch with the best in geography teaching.

SUMMER WORK IN GEOGRAPHY.—The May number of this Journal will contain the usual annual summary of the summer school opportunities in geography offered in the universities and leading normal schools. The Editor will be glad to receive printed outlines of normal and college courses in geography at an early date.

EDITORIALS

NEW ASSOCIATE EDITORS.

WE take pleasure in announcing that hereafter the Journal will have the active assistance of four new associate editors—Supt. W. W. Rupert of Pottstown, Pa.; Supt. James A. Barr of Stockton, Cal.; Supt. W. N. Clifford of Council Bluffs, Iowa, and Supervisor R. H. Whitbeck of the Model School of the Normal School, Trenton, N. J. These men are widely known for their effective work in school geography and will be able to contribute much of value in making the Journal practical and usable. The superintendents in general make the courses of study and control the effectiveness of the geography work in the schools under their guidance. Hence contributions from superintendents who have made advances in school geography will be of great assistance to the superintendents who may be a bit skeptical of the suggestions made by geographers unfamiliar with the practical school problems the school superintendent has to consider.

MEMORIZING IN SCHOOL WORK

For many years the leaders in school geography have been rightfully advocating the introduction of rational causal geography as being more valuable and disciplinary than the old fashioned memoriter work so abundant a generation ago. As a result many teachers have gone so far as to drop all pure memorizing from their school geography, believing that no location should be taught except incidentally in association with some topic developed causally. As a result pupils do not in many cases gain any clear ideas as to the location of even those places or geographical features which they must know in order to read the daily papers understandingly. It would be very delightful if all the knowledge of location necessary in daily life could be developed in a causal way. Unfortunately, however, the time that can be devoted to geography in the present crowded curriculum is altogether too small to allow such an extensive study of the world as this method of procedure would call for. Hence there are certain facts of location which a child must know and which he cannot get except by deliberately memorizing them. Such facts are not very many, but they are important and are a sufficient excuse for the introduction of pure memorizing in limited quantities even though modern educational ideals do not include such work.

Facts that must be learned in this way must be learned quickly and surely. "They must be driven home to stick;" and this means memorizing without any attempt at rational location in many instances.

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Memorizing also is valuable because it calls for concentration and prevents careless work on the part of the pupils, particularly in large classes. Thus pupils will at least gain from such work the ability to apply themselves to an uninteresting task, as they will probably have to do daily in after life.

We hope to present within the next few months suggestions as to the minimum knowledge of location a pupil must be expected to gain from his school geography. Such suggestions will give at least a basis for formulating where the line must be drawn between rational memorizing and pure memoriter work in school geography.

THE EQUIPMENT FOR PHYSICAL GEOGRAPHY IN HIGH SCHOOLS

In spite of the increased demands for better geography teaching, for better trained geography teachers and for more attention to the equipment of geographical laboratories in high schools, and in spite of the greater attention being given to scientific geography in the better high schools of the country, it still remains true that geographical laboratories in high schools are not generally as well equipped in proportion to the demands made upon them as are the laboratories devoted to the other sciences.

An analysis of the statistics presented in the recent annual report of the State Superintendent of Public Instruction in Missouri shows that twenty-eight out of fifty-three high schools in the State with an enrollment of over one hundred pupils offer work in physical geography and agriculture. The estimated total value of the equipment for science work in these fifty-three schools is a little over sixty-three thousand dollars, and in the schools reporting work in physical geography and agriculture the value of the equipment for all the sciences is approximately thirty-two thousand dollars. The total value of the geographical apparatus in the twenty-eight schools is $3,345, or less than 10 per cent. of the value of all apparatus. Of this total $2,550 is concentrated in eight schools.

Thus proportionately geography is worse equipped than any other science, in spite of the fact that agriculture is taught in association with the geography and that the teaching of agriculture is strongly urged as a very valuable subject for rural high schools.

The condition in Missouri summarized above may not be indicative of conditions in the country at large, but it is at least suggestive and shows that more attention should be given to the material side of geography teaching. Physical geography from text-books is better than none, but the best physical geography teaching must be based on realities out of doors or on the indoor representation of out of doors realities.

REVIEW

BASIS OF AMERICAN HISTORY—1500-1900[1]

PROFESSOR FARRAND'S volume on the Basis of American History is volume two in the twenty-eight volume series now being published by Harper & Brothers under the title of "The American Nation—A History." The first five volumes in this series are devoted to the "Foundations of the Nation" and are known as Group 1 of the series. The volumes of Group 1 may be secured together, but as at present planned no single volume can be secured separately.

Professor Farrand well says in his preface that trustworthy and available volumes exist dealing with the physical features and the animal and plant life of the American continent, but that there is no satisfactory volume devoted to the aborigines and their life and customs. This is his reasonable excuse for devoting a relatively small space to the physical and life environment of the American Indian. In the introductory chapters he treats the general physiography, the routes of travel, the timber and agricultural products and the animal life of 1500. In each chapter those points are emphasized which were of importance in determining the distribution of the aborigines, their manner of life, their customs and beliefs. These chapters give an excellent setting for the later chapters devoted to the different groups of Indians and to certain general summaries in reference to Indian customs, warfare and religion.

The chapter on the classification and distribution of the American Indians is especially helpful for reference and is accompanied by two maps showing the distribution of the Indian groups in 1500 and 1900.

In each chapter the author considers the social life of the Indians as well as their physical characteristics. As one reads the descriptions he feels that the author understands the Indian as a man and does not look upon him merely as an interesting specimen for physical and mental measurements. One also feels that the author speaks with authority and that he knows his subject in all its interrelations—as he does.

The book is written simply and clearly and is largely free from technical details and nomenclatures. Hence the volume is very readable for those who are not students of anthropology. The book concludes with an excellent appendix, giving annotated references to the available literature, and contains an excellent index. It covers the ground as no other book does and should be read by every student of American history and geography. The volume should be accessible in every normal school library. R. E. D.

[1] By Livigston Farrand. Pp. xviii + 301. New York, Harper & Brothers, 1904.

RECENT PUBLICATIONS

A. L. A. CATALOG—8,000 volumes for a Popular Library, with notes, edited by Melvil Dewey. Government Printing House, Washington, D. C.

The lists published in this catalogue represent the combined recommendations of a large body of critics selected from among librarians and experts in the different fields of thought. The list includes under history a large group of books devoted to general and regional geography. The entries under physical geography are meager and unsatisfactory. Arranged by subjects and by authors and very helpful for reference by teachers.

THE WORLD ALMANAC AND ENCYCLOPEDIA, 1905. Published by the New York World, 1905.

The latest volume of this indispensable handbook, like its predecessors, contains a vast amount of useful geographic information in a small compass. Accurate and usable.

EARLY WESTERN TRAVELS, 1748-1846. Edited by Reuben Gold Thwaites. Cleveland, Ohio, The Arthur H. Clark Company, 1904.

Vol. VI. Brackenridge's Journal of the Missouri, 1811: Franchère's Voyage to the Northwestern Coast, 1811-1814. pp. 410.

Brackenridge's Journal is an extremely interesting account of the Missouri country immediately after it was first explored by Lewis and Clark. Gives an excellent account of Indian life and of the ways of the buffalo.

Franchère's Voyage gives a very full and valuable account of conditions in the Columbia River country just after its first discovery. Descriptions of the social life of the Indians are very interesting. Well written, smooth and inviting reading.

Vol. VIII. Voyages, Travels and Discoveries by Tilly Buttrick, jr.; A Pedestrious Tour, of Four Thousand Miles, through the Western States and Territories, during the Winter and Spring of 1818. Estwick Evans, pp. 364.

Buttrick's account of his wanderings through the Middle West between 1812 and 1818 gives a very clear and simple account of frontier life, which forms an excellent basis for comparison with modern conditions. The difficulties of travel and the personal discomforts endured are graphically described. The constant danger from Indians and the success of the author in dealing with the Indians makes the text very spicy and interesting reading.

Evans describes how he traveled from New England through the Middle West and thence to New Orleans and the experiences he had by the way. Dressed in fur and accompanied by two faithful dogs, he lived a rough life, was frequently misunderstood, but came in close contact with people and gained a great variety of information which is graphically presented.

Vol. X. Hulme's Journal, 1818-1819; Flower's Letters, 1819 and 1820-1821; Wood's Two Years' Residence, 1820-1821.

The several journals combined in this volume deal largely with the earlier conditions of the prairie country. The life of the home and farm, the methods of travel and the general social conditions of the inhabitants are clearly and impartially portrayed. The sections devoted to the wild animals are especially interesting as showing the frontier conditions even where agriculture had been extensively developed.

CURRENT EVENTS

THE NEW SIMPLON TUNNEL

A LITTLE more than a hundred years ago Napoleon marched his great army of thirty thousand men over the Alps. It was wonderful military work, one of the famous achievements of war. By marvelous engineering, one of the famous achievements of peace, the new Simplon tunnel has just been bored under the Swiss Mountains. It is a more wonderful passage of the Alps than Napoleon's, and a hundredfold more beneficial to civilization.

The Simplon Pass always has been the great highway of travel from Switzerland into Italy. It was used by Cæsar and his legions as far back as 50 B. C., and although Napoleon happened to use the St. Bernard Pass, he recognized the superior importance of the Simplon, and ordered a military road to be built over it, to serve in future campaigns. It was begun in 1800, but before it was completed, in 1806, the fortunes of the battlefield led the Emperor elsewhere, so he never saw it. While thus constructed for war, no army ever crossed it. Instead of furnishing a route for cannons, it became a peaceful medium for international commerce.

Tourists, especially Americans, are constant travelers over the Simplon. Its scenery is grander than on any of the other Alpine passes, and the drive over it affords a most agreeable way of reaching Italy from Switzerland, or vice versa. The road is forty miles long, running between Brigue and Domo d'Ossola. The diligence does it in nine hours, twice a day in the summer season. The fare is a little over $4. At an altitude of seven thousand feet, up in a region of glaciers, avalanches and storms, the dash over the pass on top of a six-horse coach is a thrilling experience that most tourists plan to include in their European itinerary.

There are some nine refuges along the route, situated at the most dangerous places. The highest of these, near the pass itself, is the Simplon Hospice, founded by Napoleon for the rescue of hard-pressed travelers. It is conducted in connection with that other famous hospice, the one on the St. Bernard Pass. A small group of Augustine monks remain there the year round, ministering to the wants of wayfarers. Their life for the eight or nine months of winter is one of great dreariness and privation. After about twelve years of service the severity of the climate so undermines their constitutions that they are obliged to descend, with broken health, to the valleys below. As at the Bernard monastery, tourists are lodged gratuitously at the Simplon, but it is expected that they will deposit in the chapel alms-box, before they depart, as much as they would have paid at a hotel.

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It is probable that with the opening of the new railway, a large portion of the Swiss-Italian travel henceforth will go through the tunnel, instead of over the more hazardous pass-trip.

Two gangs of workmen began to bore the Simplon tunnel, the longest and most remarkable of the Alpine tunnels, in November, 1898. One gang began at the northern end, which is near Brieg, on the left bank of the Rhone; and the other gang began operations simultaneously at Iselle, on the other side of the Pennine Alps, in Italy. Twelve miles apart they started, and day and night and Sundays for five and a half years were slowly tunneling toward each other. It was a most difficult undertaking. There were layers of hard-rock formations, gneiss, gypsum and dolomite, where drilling was so slow that during the first three months of 1902, for instance, the work on the Italian end advanced only fifty feet. Other great obstacles to be overcome were the streams of underground water, and the high temperature that exists under mountain masses.

For almost six years was the labor going on, until finally one day last May, toward evening, the two gangs of workmen were so near together that they could hear each other's voices faintly. Bright and early the following morning, amid great excitement, the powerful hydraulic boring machines were set to work, and in an hour a gaping, jagged hole opened that showed dimly the electric lights glimmering in the cavern beyond. Another fall of rock, and the men who, twelve miles apart and five and a half years before, had started toward each other met face to face under the Alps. A perfect engineering achievement; the headings of the two holes came together dead opposite each other. If the tunnel had been worked from one side only it couldn't have been straighter. It was a great triumph, as the shouts of the workmen told at the time, and as every traveler who journeys through the tunnel in the future will realize.

When they were building the St. Gotthard tunnel in 1882, considered a wonderful creation in its day—the combined effort of Italy, Germany and Switzerland—the rate at which the temperature rose the farther they penetrated the mountains was an unforeseen circumstance that almost caused the abandonment of the project. Before they had gone a third of the distance the heat was so intense that more than half of the working force fell seriously ill. A large number of horses and mules succumbed from prostration, and many a laborer left the tunnel never to enter it again.

A similar problem was anticipated in regard to the Simplon tunnel, especially as the latter was three miles longer than the former, and one thousand five hundred feet deeper under the mountains; but it was solved happily by building two tunnels instead of one. These tunnels run paral-

lel, fifty-six feet apart, and are connected every two hundred and twenty yards by cross shafts, which were hermetically sealed as fast as the next one ahead was made. Through one of the tunnels fresh air was driven by the ventilation operators stationed outside in the valley. Around the last cross shaft it went, near where the men were working, and back out through the other tunnel. All injurious gases thus were carried off, and a constant current of pure air supplied. The plan worked like a charm, despite the fact that at some points the temperature ran as high as one hundred and seven degrees. When these spots were struck the hours of work were shortened considerably, and the men on leaving the tunnel were made to take cold baths, so as not to be exposed at once to the cold Alpine air outside. When they went in again they took hot baths.

The tunnel cost over a million dollars a mile. The Swiss Government, taking into account the enormous difficulties that have been encountered and surmounted, recently extended the time for completion to April 30, 1905. The boring now is mostly done, but work on the roadbed, rails and running stock still has to be completed. The government also has given the Jura-Simplon company a supplementary credit, increasing the payment from fourteen to fifteen and a half millions.

Unlike the situation at the St. Gotthard, where great artificial landing places had to be erected, both ends of the Simplon tunnel are easy of access. The present Jura-Simplon Railway, coming from Geneva, stops within a short distance of the tunnel's northern gate, while on the Italian side the train from Domo d'Ossola may readily join the new Simplon line.

The first of the great Alpine tunnels was the Mont Cenis, through which the direct French and English travel reaches Italy. It is eight miles long, was fourteen years in the building, and was finished in 1870. The second was the St. Gotthard, the chief route between Germany and Austria and the Mediterranean countries. It is a trifle more than nine miles in length, took nine years to finish, and was opened in 1880. The Arlberg came next—six and a half miles long. After three and a half years' work, it was completed in 1883.

When, this year, the new Simplon is ready for business, the Alps will have been practically annihilated. No longer will they stand in the way of that immense volume of trade and travel that goes on between northern and southern Europe.—*The Sunday Magazine.*

MAY HAVE BEARING ON PANAMA CANAL

WASHINGTON, Feb. 24.—The State Department at Washington to-day received the following cablegram about the completion of the Simplon

tunnel from Consul Washington, at Geneva: "Simplon pierced. News received with general rejoicing and firing of salutes."

The successful outcome of this engineering feat may have an important bearing upon the project of Chief Engineer Wallace of the Panama Canal, to make that waterway a sea level canal by driving a tunnel four miles long under a mountain to divert the surplus waters of the Chagres River.

THE STRUGGLE OVER CORN SHIPMENTS

The railroads that touch the great Trans-Mississippi corn belt are engaged in a warm contention as to the route by which corn destined for export to Europe shall be sent. Up to the present it has been the prevailing custom with shippers to send corn by the railroad routes that have terminals in Boston, New York, Philadelphia, and Baltimore. But now the railroads that run south to the gulf, through the Mississippi Valley, are offering lower rates to New Orleans and Galveston, and so are diverting the corn traffic from the Atlantic ports to the Gulf ports. The situation is a simple one. The mileage from the corn States to the Gulf is considerably less than to Atlantic ports. At the same time the water route from New Orleans and Galveston to Europe is considerably longer than from Boston or New York. But water transportation is now at such low rates that a longer sea journey scarcely enters the problem. The natural disadvantages affect the easternbound railroads, and it is problematical whether they will be able to hold their own against the southbound lines to the Gulf. The serious feature of the struggle is to the eastbound lines, which may lose a large share of their income; to the Atlantic ports in the decrease of their exports, and especially to Chicago, whose monster elevators have handled by far the major portion of the corn shipments. Incidentally, the Erie Canal would be affected unfavorably. It is a large-sized problem; but geography will settle it, since few have ever fought against geography and prevailed.

CORN GOSPEL TRAIN

Practical education is brought almost to the doors of the farmers of the Middle West. The success of the "Corn Gospel Train" last year, from which Professor P. G. Holden lectured to the Iowa corn growers on the proper methods of planting, has led the Missouri Pacific Railroad to send out an agricultural exhibit car to all the large towns along its lines, says *World's Work*. The car was equipped with literature and lecturers, as well as with an exhibit. The car was sent out for the purpose of teaching the farmers how to increase their crops. Circulars and handbills were sent to the farmers ahead announcing the time of the car's arrival. A crowd assembled at each stopping place of the car. The speakers were

men acquainted with the resources and possibilities of the sections visited. Corn experts, for example, discussed all phases of corn growing with the Iowa farmers.

Most of the meetings were held in the car, but in some cases overflow meetings were held outside. One result of the trip was the planting of 300,000 fruit trees along the line of the railroad.

What has happened along the route of the Missouri Pacific Railroad will happen along the line of other roads, thus making for a wider and better education of the farmers who are unable to attend the State Agricultural College.—*Journal of Education.*

THE MONARCH GEYSER

Those who have visited Yellowstone Park can never forget the eruptions of "Old Faithful" and his numerous kindred. But it is said that, awe-inspiring as these are, they are nothing but pigmies compared with the geyser Waimangu, near Roturna, New Zealand. This is really a baby geyser, as it made its appearance only about two years ago. The crater is nearly half an acre in extent, and very deep. At the time of eruption this immense crater is completely filled with black mud, stones, and steam. So great is the explosive force that mud and stones are occasionally thrown to a height of 1,000 feet. New Zealand, in many respects, is "Nature's Wonderland," but Waimangu must be accounted as one of her greatest attractions.

NOTES

ERITREA'S NEW CAPITAL.—The Government offices of the Italian colony of Eritrea have long been centered at Massowa on the Red Sea. They are now to be removed to the high plateau of the hinterland on account of the very trying climatic conditions of Massowa. The Government has adopted the suggestion of Mr. Ferdinand Martini, Governor of the colony since 1897, to transfer the capital to Asmara, sixty miles in the interior and forty-two miles from Macatat, the present inland terminus of the railroad. In 1897, when the Italians first occupied Asmara, it contained only a few scores of huts and an Abyssinian fort. The town now has a population of 9,000, including about 1,000 Europeans, all Italians excepting a few Greeks and some Norwegian missionaries. It has some aspects of European towns, with a few superior dwellings, cafés, a theater, a casino, a hotel, a postoffice, and handsome public and private gardens. It is situated only a mile and a half from the edge of the plateau, is in the midst of splendid pastures, and around it flourish many varieties of trees and some European crops.

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None of the typical tropical diseases has a foothold in Asmara, which is 7,800 feet above the sea, with a maximum temperature of 88 degrees F., and a minimum of about 14 degrees. The town is reached from the end of the railroad by a remarkable wagon road built by the Italians in 1900-01. The road is forty-two miles long, winds from terrace to terrace, through deep cuts and numerous tunnels, is wide enough for wagons to pass one another, and is rendered safe at its outer edge by a barrier of timbers.

Bull. Am. Geog. Soc., Jan. 1, 1905.

CURRENT ARTICLES ON COMMERCE AND INDUSTRY:—

January:—

Accidents: The Railroad's Death-roll, *World's Work.*

Agriculture, Vital Facts of, I., *Country Life in Am.*

Agriculture: "The Farmers of the U. S.", *Nat'l Geog. Mag.*

Asia: "Merchandising in the Orient," *Comm. Bull, and N. W. Trade,* Jan. 28.

Canals: "New Ways About the World," *World's Work.*

Chili Nitrates, *Bull. of Bureau of Am. Republics,* Dec.

China, Canals in, *Cons. Rep.* Dec.

Corn: "Wealth on the Cob" (Ill.), *Sat. Evening Post,* Jan. 7.

Dairy, How to Manage a Successful (Ill.), *Country Life in Am.*

Employment: "How to Secure Right Men," *System.*

Foods and Drinks, Adulterated, *Sat. Evening Post,* Jan. 14.

Furs, Imitation of Valuable Skins, *The Shoe Retailer,* Jan. 25.

Germany: "Government by Experts," *Cons. Rep.* Dec.

Harbor, The New York (Ill.), *Sci. Am.,* Jan. 7.

Honesty, Commercial, *The Mfr.,* Jan. 7.

Immigration, The Character of, Past and Present, *Nat'l Geog. Mag.*

Macaroni, The Manufacture of, (Ill.), *Sci. Am.,* Jan. 7.

Merchant Marine, *Sci. Am.,* Jan. 7.

Pawnbroking: "At the Sale of the Unredeemed" (Ill.), *Century.*

Pittsburg, Symposium, *Rev. of Revs.*

Power: "A Practical Wave-Motor" (Ill.), *World-ToDay.*

Prune, and its Cultivation (Ill.), *Sci. Am.,* Jan. 7.

Retail Trade: "Mr. Bland, The Grocer," *Ladies' Home Journal.*

Russia, The Leather Industry of, *Hide and Leather,* Jan. 28.

Silk Production, The World's, *Cons. Rep.,* Dec.

Welfare Work of the Colorado Fuel and Iron Co. (Ill.), *Business Man's Mag. and Bookkeeper.*

E. D. J.